

SALMON-TAGGING EXPERIMENTS IN ALASKA, 1929¹

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INTRODUCTION

The extensive salmon-tagging experiments which have been conducted in Alaska since 1922 were continued during 1929 in central Alaska, under the general direction of Dr. Willis H. Rich. The investigation was intended to determine the direction of migration from the entrances of Cook Inlet and Prince William Sound, and from prominent points by which the fish pass to reach the spawning grounds of those regions. The method of tagging has been adequately described in previous reports.²

Because those areas are comparatively small and the fish entering them are largely bound for local spawning grounds, it seemed unnecessary to tag a very great number of salmon. An effort was made, however, to conduct the operations early in the season and again during the height and toward the end of the run, to determine whether the migration and distribution of the fish varied during the season.

The accompanying map will serve to show the general geography of central Alaska; and the following list includes all minor localities from which tagged fish were recorded.

¹ Submitted for publication Apr. 1, 1930.

² "Experiments in tagging adult red salmon, Alaska Peninsula Fisheries Reservation, summer of 1922," by Charles H. Gilbert. *Bulletin, U. S. Bureau of Fisheries, Vol. XXXIX, 1923-24, (1924), pp. 39-50, 1 fig., Washington.* "Second experiment in tagging salmon in the Alaska Peninsula Fisheries Reservation, summer of 1923," by Charles H. Gilbert and Willis H. Rich. *Ibid., Vol. XLII, 1926 (1927), pp. 27-75, 12 figs., Washington.* "Salmon-tagging experiments in Alaska, 1924 and 1925," by Willis H. Rich. *Ibid., pp. 109-146, 1 fig., Washington, 1926.* "Salmon-tagging experiments in Alaska, 1926," by Willis H. Rich and Arnie J. Suomela. *Ibid., Vol. XLIII, 1927, Pt. II (1929), pp. 71-104, 17 figs., Washington, 1927.* "Salmon-tagging experiments in Alaska, 1927 and 1928," by Willis H. Rich and Frederick G. Morton. *Ibid., Vol. XLV, 1929, pp. 1-23, 2 figs., Washington, 1929.*

SUPPLEMENTARY LIST OF MINOR LOCALITIES FROM WHICH TAGGED SALMON WERE RECORDED

PRINCE WILLIAM SOUND

Anderson Bay. Hinchinbrook Island, 4 miles east of Johnstone Point.

Bainbridge Passage. Between Bainbridge Island and the mainland.

Bay of Isles. East shore of Knight Island, 17 miles north of Point Helen.

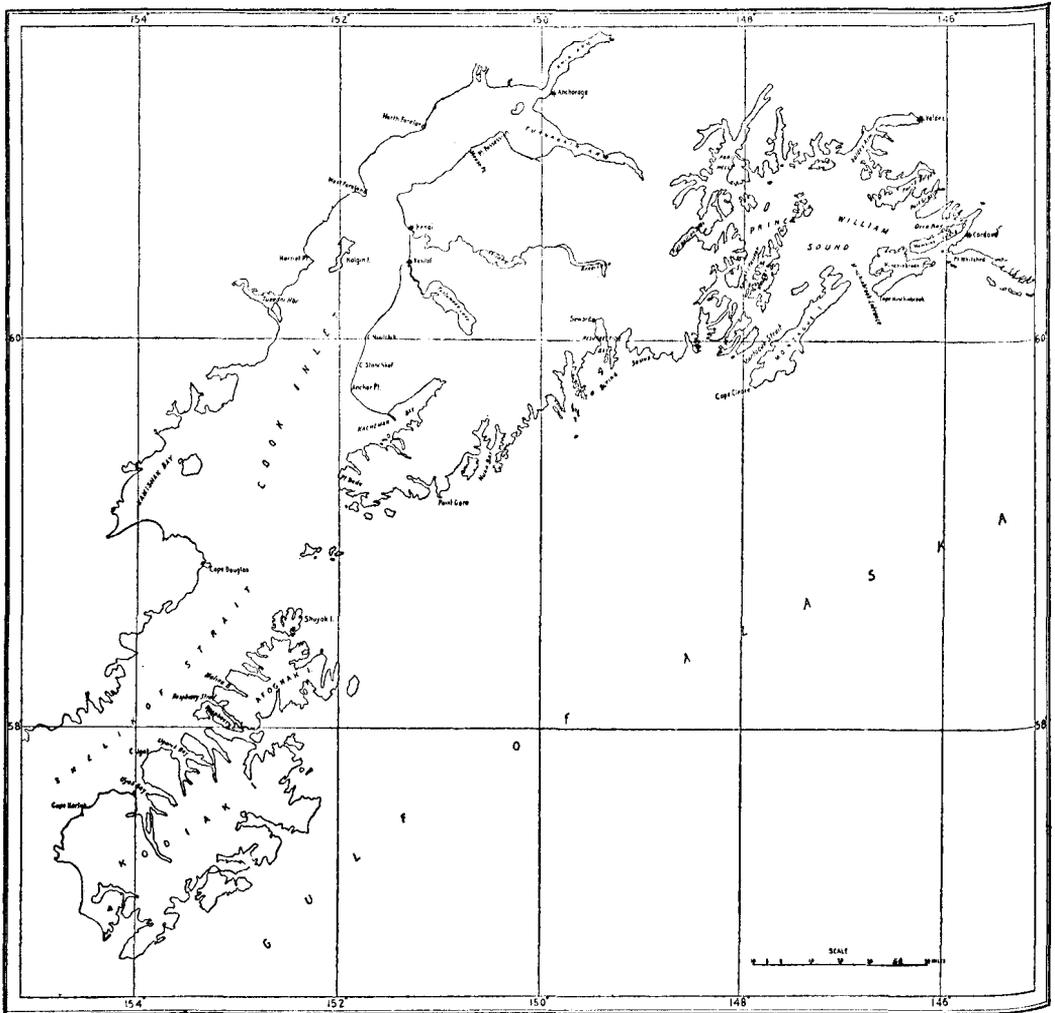


FIGURE 1.—Portion of the Gulf of Alaska showing Cook Inlet and Prince William Sound districts

Bidarka Point. North entrance of Port Fidalgo.

Bligh Island. Southeast of Valdez Arm.

Bluff Point. Montague Island. Exact location doubtful.

Cape Cleare. Southwest end of Montague Island.

Dangerous Passage. Between north shore of Chenega Island and the mainland.

Drier Bay. West shore of Knight Island, 3 miles north of Squire Island.

Eaglek Bay. Northwest shore, about 3 miles west of Unakwik Inlet.

Glacier Bay. Northwest shore of Montague Island, about 8 miles northeast of Hanning Bay.

Granite Bay Point. About 2 miles south of Point Nowell.

Hanning Bay. Montague Strait, about 14 miles northeast of Cape Cleare.

Hawkins Cutoff. Between Hawkins Island and Hinchinbrook Island.

- Herring Bay. Northwest shore of Knight Island, about 15 miles north of Squire Island.
 Hogan Bay. East shore of Knight Island, 2 miles north of Point Helen.
 Humpback Creek. Orca Inlet, about 6 miles northeast of Cordova.
 Jack Bay. East shore of Valdez Arm, about 12 miles northeast of Point Freemantle.
 Jackpot Bay. Dangerous Passage, about 11 miles southwest of Point Nowell.
 Johnson Cove. Location unknown. Probably Jackson Cove, Glacier Island.
 Johnstone Point. Northwest point of Hinchinbrook Island.
 Knowles Head. On mainland about 5 miles south of Port Fidalgo.
 Latouche Passage. Between Elrington Island and Latouche Island.
 Makaka Point. Southwest end of Hawkins Island.
 Marsha Bay. East shore of Knight Island, 12 miles north of Point Helen.
 McLeod Harbor. Montague Strait, 7 miles northeast of Cape Cleare.
 Pigot Bay. Southwest shore of Port Wells.
 Point Freemantle. Western entrance of Valdez Arm.
 Point Pellew. Eastern entrance of Eaglek Bay.
 Porcupine Point. South entrance of Port Fidalgo.
 Port Chalmers. Montague Island, about 10 miles south of Montague Point.
 Red Head. Western entrance of Port Gravina.
 Rocky Bay. Montague Island, 1 mile south of Montague Point.
 Rocky Point. Montague Island, 1 mile northeast of Hanning Bay.
 Sandy Point. Montague Island, 6 miles northeast of Hanning Bay.
 Sawmill Bay. West shore of Valdez Arm, 10 miles northeast of Point Freemantle.
 Seven Sisters. Hinchinbrook Island, 1½ miles south of Johnstone Point.
 Sheep Bay. Northeast shore of Orca Bay, 3 miles east of Gravina Point.
 Shelter Bay. Hinchinbrook Island, 3 miles south of Johnstone Point.
 Simpson Bay. Northeast shore of Orca Bay, 11 miles east of Gravina Point.
 Siwash Bay. West shore of Unakwik Inlet, about 8 miles north of entrance.
 Squire Island. Near southwest shore of Knight Island.
 Valdez Bay. Same as Port Valdez.
 Wells Bay. North shore of Prince William Sound, 1½ miles east of Unakwik Inlet.
 Whale Bay. Southwest shore of Prince William Sound, 7 miles west of Squire Island.
 Windy Bay. Orca Bay, 11 miles northeast of Makaka Point.
 Zaikof Bay. Montague Island, 5 miles south of Montague Point.

COOK INLET

- Anchor Point. North entrance of Kachemak Bay.
 Bluff Point. Kachemak Bay, about 11 miles southeast of Anchor Point.
 Boulder Point. East shore of Cook Inlet, 6 miles northeast of East Foreland.
 Cape Ninilchik. East shore, about 19 miles north of Anchor Point.
 Cape Starichkof. East shore, about 8 miles north of Anchor Point.
 Chisik Island. West shore, at entrance to Tuxedin Harbor.
 Cottonwood Point. District north of Three Mile Creek.
 Dangerous Cape. North entrance of Port Graham.
 Deep Creek. Between Cape Ninilchik and Ninilchik Village.
 Dogfish Bay. Koyuktolik Bay, 5 miles south of Point Bede.
 English Bay. About 3 miles northeast of Point Bede.
 False Cape. Part of Dangerous Cape.
 Flat Island. One mile north of Point Bede.
 Humpy Point. Cape Kasilof, 3 miles south of Kasilof.
 Kalifonski. About 4 miles north of Kasilof.
 Kamishak Bay. Southwest coast of Cook Inlet.
 Kenai. East shore of Cook Inlet at the mouth of the Kenai River.
 K. R. P. Co. trap No. 3. East shore, 9½ miles north of Ninilchik.
 Lila Bay. Unknown.
 Mallard Bay. In Kachemak Bay; exact location doubtful.
 McDonald Spit. South shore of Kachemak Bay, approximately 5 miles east of Seldovia Bay.
 Moose Point. East shore of Cook Inlet, 30 miles northeast of East Foreland.
 Nikishka Bay. Three miles northeast of East Foreland.

Ninilchik. East shore, approximately 21 miles northeast of Anchor Point.
 Nubble Point. Kachemak Bay, 4 miles east of Seldovia Bay.
 Point Harriet. West shore, 7 miles west of Kalgin Island.
 Point McManus. About 32 miles northeast of East Foreland.
 Point Naskowhak. Western entrance of Seldovia Bay.
 Port Chatham. East shore, about 9 miles south of Point Bede.
 Port Graham. About 4 miles northeast of Point Bede.
 Sadie Cove. South shore of Kachemak Bay about 8 miles east of Seldovia Bay.
 Salamato Beach. East shore, about 7 miles south of East Foreland.
 Seldovia Bay. South shore of Kachemak Bay, near the entrance.
 Sunset Packing Co. trap No. 1. East shore, 18 miles northeast of East Foreland.
 Sunset Packing Co. trap No. 3. East shore, 21 miles northeast of East Foreland.
 The Sisters. East shore, 8 miles south of Kasilof.
 Three Mile Creek. West shore, latitude 61° 9'.
 Tutka Bay. South shore of Kachemak Bay, about 7 miles east of Seldovia Bay.
 Tyonek. West shore at North Foreland.
 Waterfall. About 10 miles south of Cape Kasilof.
 Windy Bay. East shore, 17 miles west of Point Gore.

KODIAK ISLAND

Cape Ugat. Between Uganik Bay and Uyak Bay.
 Malina Strait. Same as Raspberry Strait, separating Raspberry Island and Afognak Island.

In the course of the 1929 operations, approximately 4,150 tagged fish were released.

The record of the tags attached is given in Table 1.

TABLE 1.—Tags attached in central Alaska, 1929

Experiment No.	Date	Serial Nos.	Species of fish tagged					Locality
			Red	Pink	Chum	Coho	King	
1	June 14	4701-4850 4901-5000	127	43	20		1	Flat Island.
2	June 26	4851-4950 5001-5300	138	210	51			Nubble Point.
3	June 27	5301-5500 5551-5575	45	99	80		1	Flat Island.
4	July 4	7001-7300	9	281	3	1	6	Point Bryant.
5	July 5	7301-7600		299	1			Montague Point.
6	July 5	7601-8000		400				Port Etches.
7	July 12	8001-8200		200				Squire Island.
8	July 13	8201-8400		200				Hanning Bay.
9	July 13	8401-8600		200				Montague Point.
10	July 15	8601-8750	1	121	23	5		Johnstone Point.
11	July 18	5601-5800	13	187				Nubble Point.
12	July 21	5801-6050	245			3		Nikishka Bay.
13	July 22	6050-6400 5501-5550	262	121		27		Cape Starichkof.
14	July 23	5576-5600 6401-6600	18	171	67	18		Flat Island.
15	July 30	8751-8900 6601-6700	5	221	20	4		Johnstone Point.
16	July 31	6701-6950		250				Montague Point.

PRINCE WILLIAM SOUND

RETURNS FROM EXPERIMENTS IN MONTAGUE STRAIT

Pink salmon.—Experiments were conducted at Point Bryant and at Hanning Bay in which 481 pink salmon were tagged and liberated. Of this number, 171 (35.6 per cent) were recaptured in many localities in Prince William Sound. The data are presented in Table 2. Two main routes of migration are indicated and are shown graphically in Figure 2. The movement northeast along Montague Island to Hinchinbrook Entrance and from there to many of the bays and inlets tributary to

the east shore of Prince William Sound appears to be of somewhat greater importance than that through Knight Island Passage to the spawning grounds along the western shore. Sixty-six (38.6 per cent) of the recaptured salmon were taken along the shore of Montague Island northeast of the locality of tagging. One tagged fish was reported

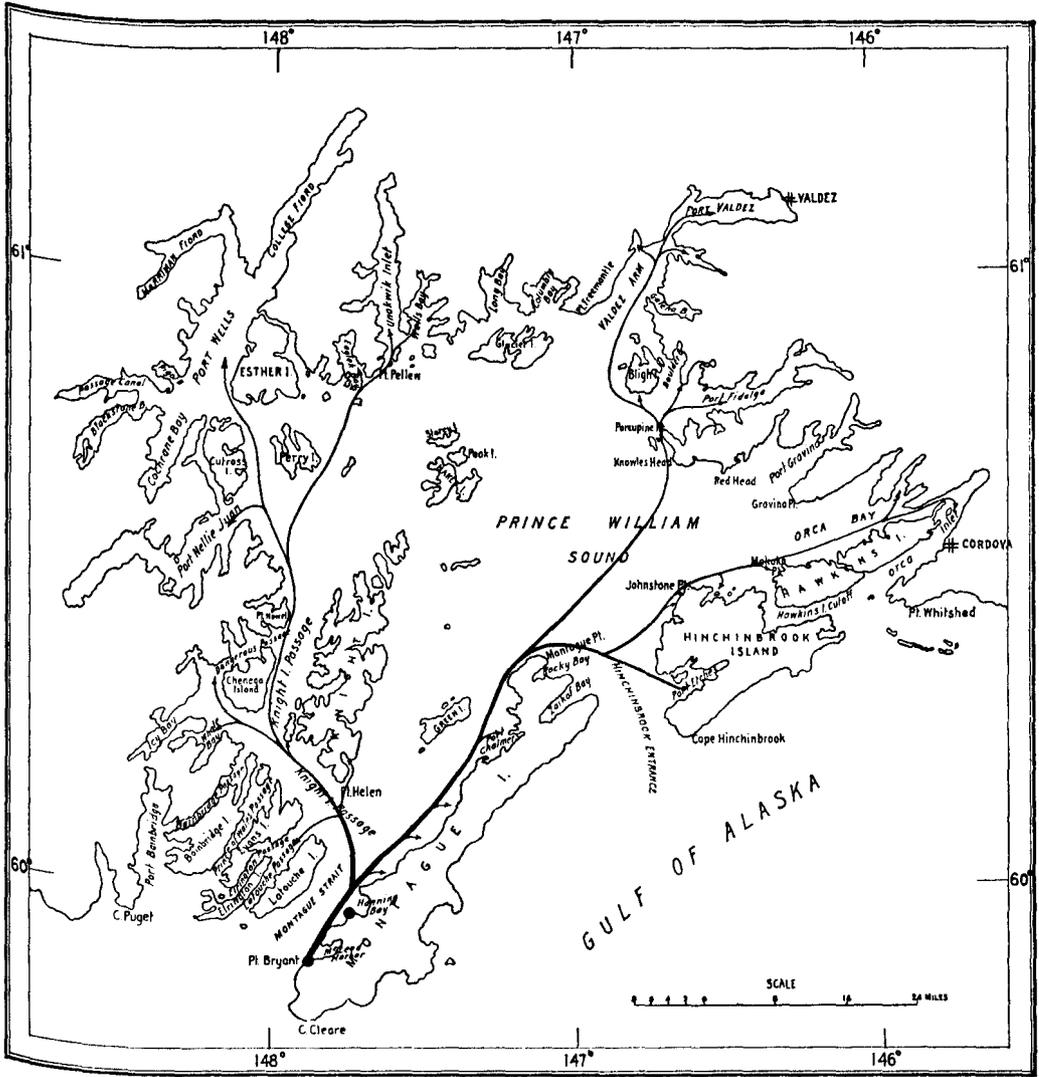


FIGURE 2.—Distribution of pink salmon tagged in Montague Strait

to have been taken in Cook Inlet, but more specific information was not available, and the accuracy of the report is questionable.

There were no important differences in the direction of migration or distribution of the fish tagged during the early part of the season and those tagged at its height. The fish liberated in the first experiment were, however, recaptured after a greater period of freedom, indicating a somewhat slower rate of travel.

TABLE 2.—Returns from pink salmon tagged in Montague Strait

Locality of recapture	Locality and date of tagging				Total number recaptured	Locality of recapture	Locality and date of tagging				Total number recaptured	
	Point Bryant, July 4		Hanning Bay, July 13				Point Bryant, July 4		Hanning Bay, July 13			
	Number	Time in days	Number	Time in days			Number	Time in days	Number	Time in days		
Montague Island:												
No details.....	13	1-25	13	3-19	26	Port Etches.....	5	7-18	3	7-12	8	4
McLeod Harbor.....			3	15-34	3	Seven Sisters.....	3	7-19	1	6	1	4
Hanning Bay.....	3	6-8	4	4-8	7	Johnstone Point.....			1	20	1	4
Sandy Point.....			9	4-9	9	Anderson Bay.....	3	5-14	1	18	2	2
Rocky Point.....	5	1-28	4	4-9	9	Makaka Point.....	2	6-7			1	1
Glacier Bay.....	4	13-24	5	8-15	9	Orca Inlet.....	1	4			2	2
Port Chalmers.....	3	12			3	Simpson Bay.....	2	4-15			3	8
Latouche Passage.....	2	7			2	Knowles Head.....	1	5	7	4-13	1	2
Whale Bay.....			2	3-14	2	Porcupine Point.....			1	14	1	1
Knight Island:						Port Fidalgo.....	1	6			1	1
Hogan Bay.....	1	23			1	Bidarka Point.....	1	4	1	11	2	5
Drier Bay.....	1	15			1	Bligh Island, south end.....	4	5-21	1	6	1	1
Squire Island:			13	6-14	13	Port Valdez:						
Dangerous Passage:						Jack Bay.....	2	20-23	2	13-21	4	3
No details.....	2	19			2	Sawmill Bay.....	1	23	2	14-21	2	2
Chenega Island.....	1	13			1	Valdez Bay.....	1	19	1	9	1	1
Granite Bay Point.....	4	15-29	2	9-13	6	Johnson's Cove.....			1	20	1	1
Port Nellie Juan.....	1	27			1	Prince William Sound, east shore.....	10		13		13	1
Port Wells.....			3	18-20	3	Cook Inlet.....	1	21			1	1
Eaglek Bay.....			3	13-19	3							
Point Pellew.....	2	19-22			2							
Stwash Bay.....			1	13	1							
Wells Bay.....	4	19			4							
						Total.....	84		87		171	35.6
						Per cent returned.....	29.9		43.5			

¹ Date of capture not reported.

Red salmon.—Nine red salmon were tagged here and one was recaptured in Simpson Bay 29 days later.

RETURNS FROM EXPERIMENTS AT MONTAGUE POINT

Pink salmon.—The data secured from the tagging of pink salmon at Montague Point are given in Table 3 and are graphically shown in Figure 3. Three experiments were conducted here in which 749 pinks and 1 chum salmon were tagged. The latter was not recaptured. Of the pink salmon, 271 (36.1 per cent) were recaptured in all parts of Prince William Sound. The dispersion of the fish tagged on July 5 and on July 13 was almost identical. However, those tagged on July 31 were, with few exceptions, taken within a comparatively short time in the immediate vicinity of Montague Point. This may have been due to the fact that commercial fishery operations ceased within a week after the tagging, but the taking of 28.3 per cent of the recaptures in Rocky Bay by purse seines would indicate that the fish were bound for near-by spawning grounds.

The fish tagged here are doubtlessly derived, in part, from the fish entering Prince William Sound through Montague Strait. Others may have entered through Hinchinbrook Entrance but, as seen from the experiment at Port Etches, they are not associated with the fish caught along the east shore of Hinchinbrook Entrance. It is probable that the salmon liberated at Montague Point had entered the sound through both entrances and were a mixed lot. This would account for the wide scattering of fish from this point, for had all of them been derived from fish entering through Montague Strait only an extensive northerly and easterly migration would have been expected.

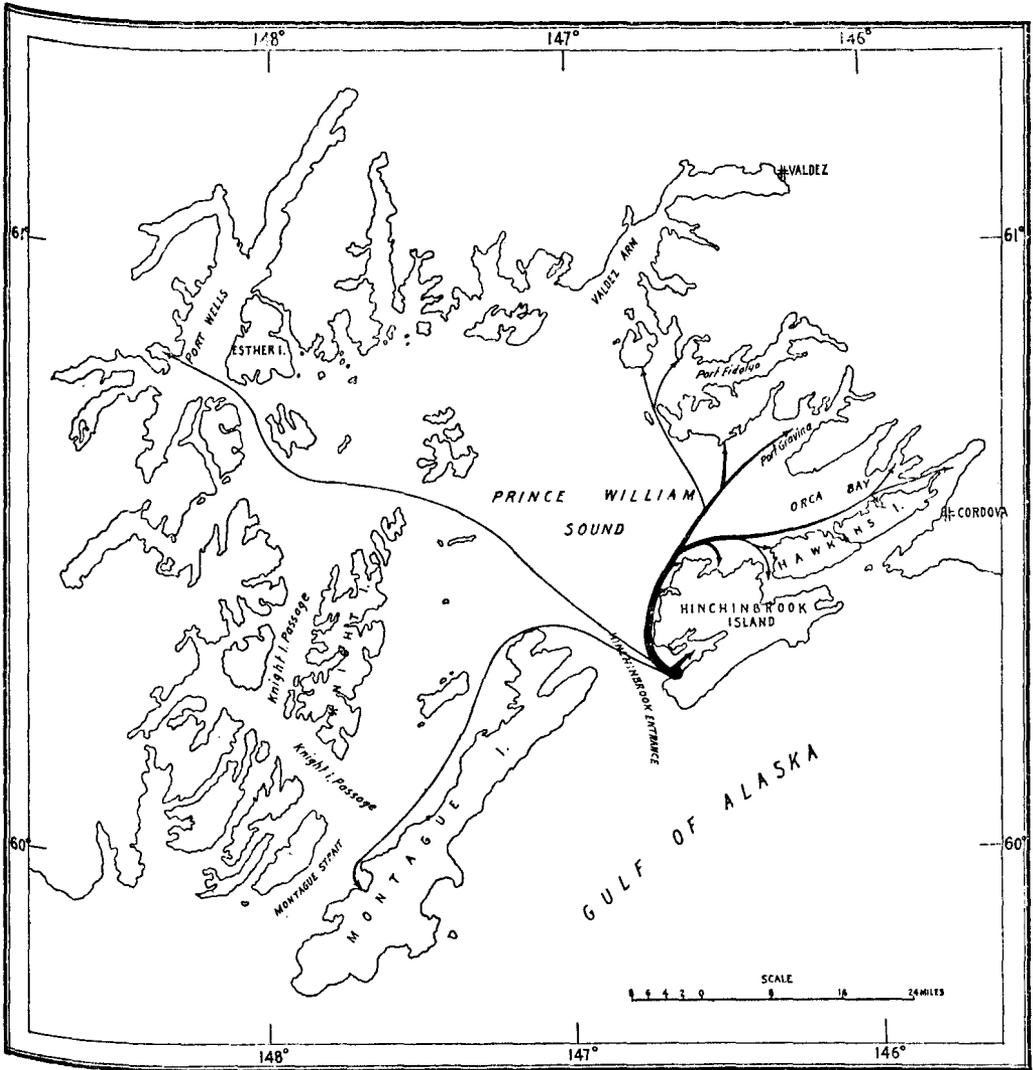


FIGURE 3.—Distribution of pink salmon tagged at Montague Point

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TABLE 3.—Returns from pink salmon tagged in Montague Point

Locality of recapture	Date of tagging						Total number recaptured
	July 5		July 13		July 31		
	Number	Time in days	Number	Time in days	Number	Time in days	
Montague Island:							
No details	40	1-28	23	3-19	135	1-2	103
Zaikof Bay	1	24	1	16			2
Rocky Bay	1	21	1	13	19		21
Port Chalmers	1	10	1	5			2
Glacier Bay	4	16-23	1	12			5
Rocky Point	1	10	1	6			2
Bluff Point	1	22	1	4			2
Sandy Point	1	13	1	5			2
Hanning Bay	3	5	1	8			4
McLeod Harbor			1	15			1
Cape Cleare	1	19	1	11			2
Port Etches	5	4-20	3	1-11	1	2	14
Shelter Bay	1	11	1	4			2
Seven Sisters	1	11	5	4-12			6
Anderson Bay	1	7	2	9-13			3
Makaka Point	1	6	2	4			3
Hawkins Cutoff			3	1			1
Orca Inlet	2	14-26					2
Simpson Bay	1	6					1
Red Head	3	28	3	5-6			6
Knowles Head			1	11			1
Porcupine Point			1	6			1
Port Fidalgo	3	5-17					3
Bidarka Point	1	3					1
Bligh Island	2	6	1	12			3
Valdez Arm:							
Point Freemantle	1	28			3	1	2
Jack Bay	1	15					1
Sawmill Bay			1	21			1
Squire Island	3	6	10	3-10			13
Knight Island:							
Bay of Isles			1	6			1
Marsha Bay	1	16					1
Hogan Bay	1	22					1
Drier Bay	6	18-25	3	17			9
Herring Bay			1	6			1
Whale Bay	3	16-22	2	9			5
Dangerous Passage	3	27					3
Granite Bay Point	5	7-12	4	9-11			9
Port Nellie Juan					3	1	1
Port Wells			1	20	1	2	2
Eaglek Bay	1	21	1	13			2
Point Pellew	4	20-21	2	17	3	2	8
Wells Bay					3	1	1
Prince William Sound, east shore	4		3		4		17
Total	112		92		67		271
Per cent return	37.5		46.0		26.8		36.1

¹ Ten reported taken before date of tagging.
² All reported taken before date of tagging.

³ One reported taken before date of tagging.
⁴ Date of capture not reported.

RETURNS FROM EXPERIMENT IN HINCHINBROOK ENTRANCE

Pink salmon.—Four hundred pink salmon were tagged in Hinchinbrook Entrance at Port Etches. Of these fish 194 (48.5 per cent) were recaptured, with two exceptions, along the east shore of Prince William Sound. Of the recoveries, 53.6 per cent were made in Port Etches after a time of from 1 to 28 days and after an average length of time of 6.3 days. The data are presented in Table 4 and are graphically shown in Figure 4.

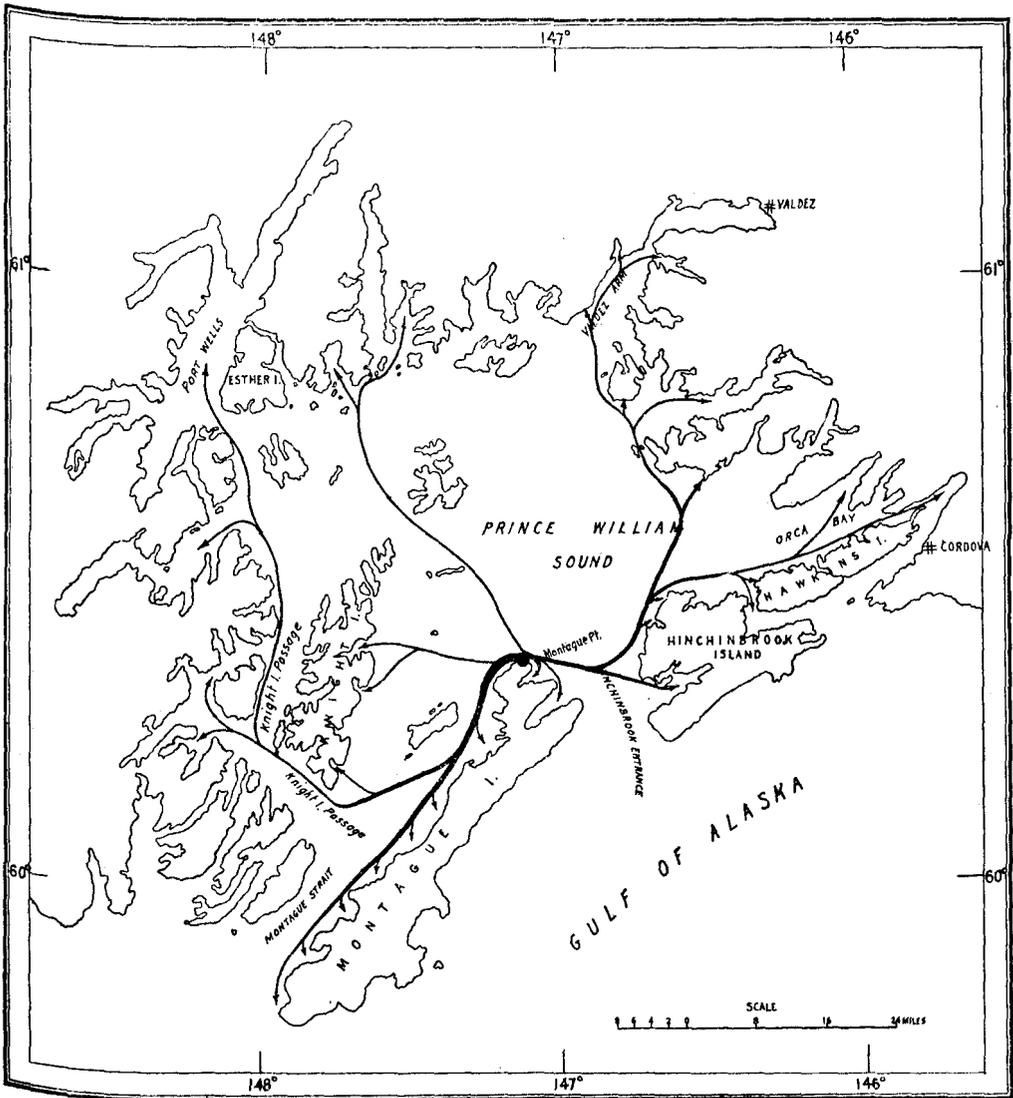


FIGURE 4.—Distribution of pink salmon tagged in Hinchinbrook Entrance

TABLE 4.—Returns from pink salmon tagged at Port Etches, Hinchinbrook Entrance, July 5

Locality of recapture	Number	Time in days	Locality of recapture	Number	Time in days
Port Etches	104	1-28	Port Gravina	8	5-14
Shelter Bay	9	3-13	Red Head	9	8
Seven Sisters	6	6-20	Knowles Head	1	12
Anderson Bay	21	1-28	Bidarka Point	1	5
Hawkins Cutoff	2	13-19	Bigh Island	1	20
Hawkins Island:			Port Wells: Pigot Bay	1	3
No details	2	6	Montague Island: Hanning Bay	1	4
Makaka Point	9	5-12	East shore Prince William Sound	1	16
Windy Bay	1	17	Total	194	
Orca Inlet: Humpback Creek	1	17	Per cent returned	48.5	
Simpson Bay	1	6			

¹ Date of capture not reported.

RETURNS FROM EXPERIMENT IN KNIGHT ISLAND PASSAGE

Pink salmon.—Two hundred pink salmon were tagged at the south end of Squire Island and 72 (35.5 per cent) were recaptured. The migration from this locality is principally north through Knight Island Passage to the spawning streams along the

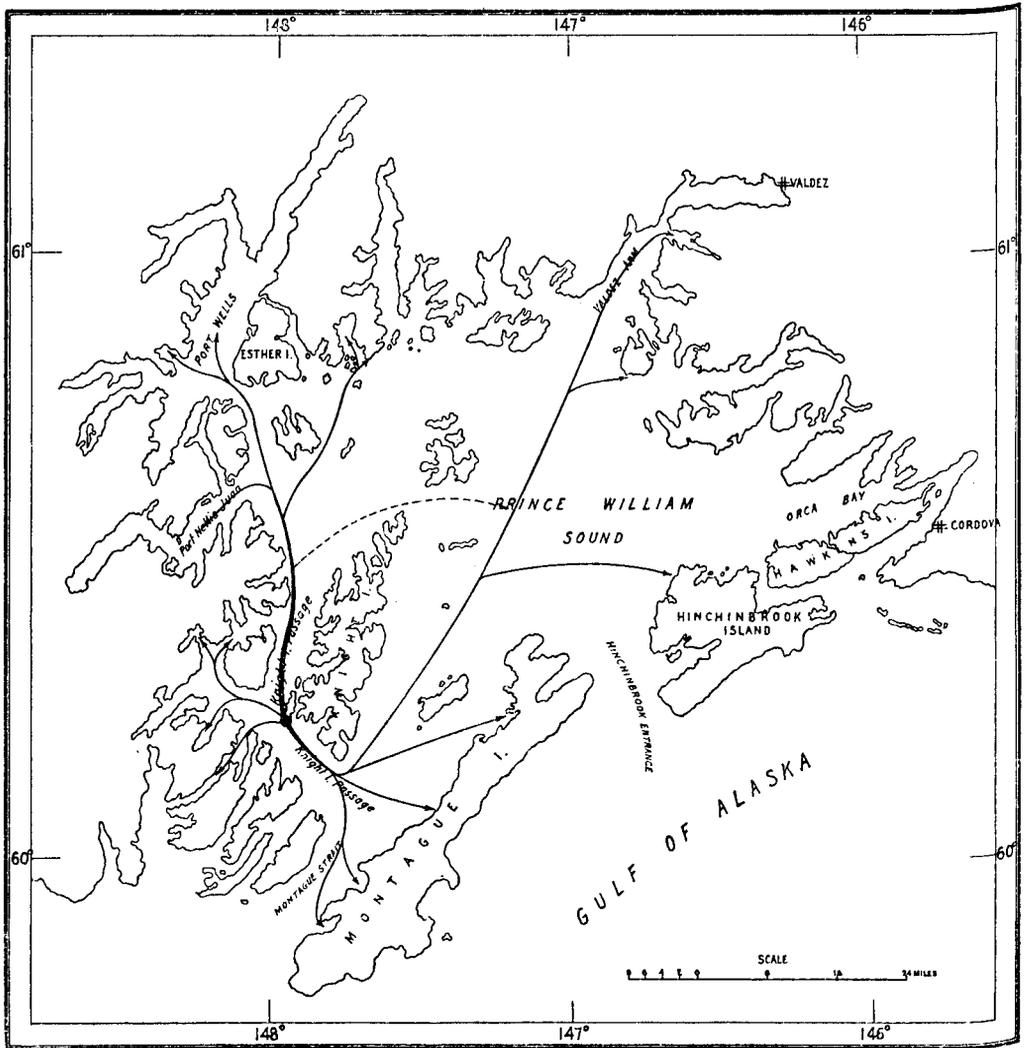


FIGURE 5.—Distribution of pink salmon tagged in Knight Island Passage

west shore of the sound. Four fish were recaptured on Montague Island, and four were taken in three widely separated localities on the east shore. The data are given in Table 5 and Figure 5.

TABLE 5.—Returns from pink salmon tagged at Squire Island, Knight Island Passage, July 12

Locality of recapture	Number	Time in days	Locality of recapture	Number	Time in days
Squire Island	1	23	Knight Island:		
Bainbridge Passage	1	7	Marsha Bay	3	9
Montague Island:			Hogan Bay	2	15
No details	4	11-20	Drier Bay	2	8-14
McLeod Harbor	1	16	Port Nellie Juan	1	10
Hanning Bay	1	9	Port Wells:		
Glacier Bay	1	13	No details	2	1-6
Port Chalmers	1	6	Pigot Bay	2	13
Seven Sisters	1	6	Eaglek Bay	2	10-18
Dangerous Passage:			Point Pellew	2	18
No details	3	1	Valdez Arm: Jack Bay	2	11-19
Jackpot Bay	1	13	Bligh Island	1	7
Granite Bay Point	11	1-12	Prince William Sound, east shore	2	1
Whale Bay	4	15-16			
			Total	72	
			Per cent returned	35.5	

¹ Two reported taken before date of tagging.

² Date of capture not reported.

It has often been suggested that the fish taken at Squire Island enter Prince William Sound chiefly through Bainbridge and Prince of Wales Passages, but the number of fish tagged in Montague Strait and recaptured at Squire Island would indicate a very definite westward migration from Montague Strait through Knight Island Passage. It seems probable, therefore, that the majority of the fish that pass

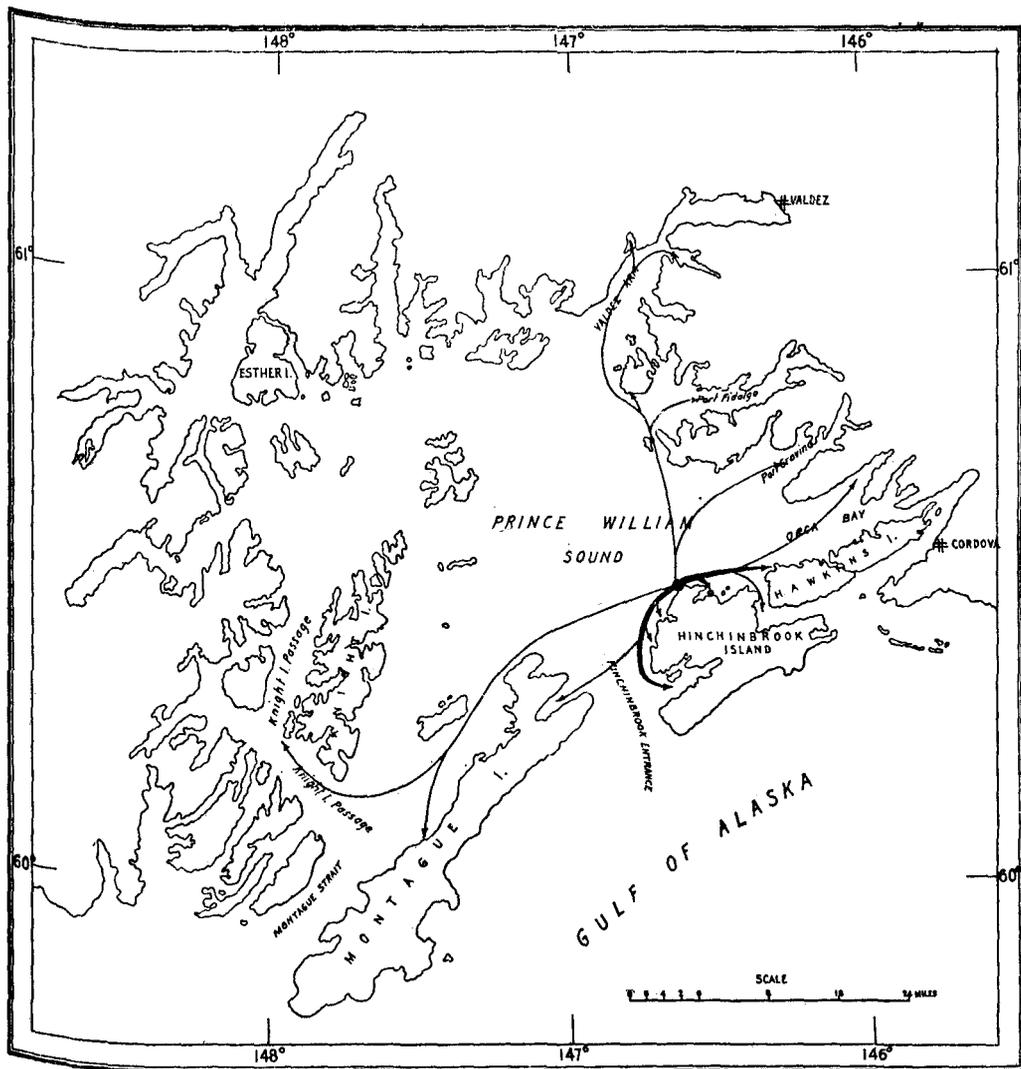


FIGURE 6.—Distribution of pink salmon tagged at Johnstone Point

through Knight Island Passage enter from Montague Strait and not through the other smaller channels.

RETURNS FROM EXPERIMENTS AT JOHNSTONE POINT

Pink salmon.—Tagging experiments were conducted at Johnstone Point on July 15 and again on July 30. In these experiments, 342 pink salmon were tagged and 117 (34.2 per cent) were recaptured. The recaptures, with few exceptions, were made along the east shore of Prince William Sound. The returns are shown in Table 6 and Figure 6.

Red salmon.—Six red salmon were tagged here and one was recaptured three days later at Knowles Head.

Chum salmon.—Forty-three chums were tagged and eight were recaptured later. All of the recaptured chum salmon were tagged during the experiment of July 15. The data are given in Table 6 showing that the chum salmon taken here were of local origin, spawning in the streams emptying into the bays in the vicinity of Johnstone Point.

Coho salmon.—Nine cohos were tagged and three were later recaptured. Two were taken at Rocky Point on Montague Island after 7 and 15 days, and one was captured in Port Etches after 3 days.

TABLE 6.—Returns from salmon tagged at Johnstone Point

PINK SALMON

Locality of recapture	Date of tagging				Total number recaptured
	July 15		July 30		
	Number	Time in days	Number	Time in days	
Anderson Bay.....	1	17	1	13	30
Hawkins Cutoff.....			1	1	1
Makaka Point.....	1	4	5	3-23	6
Sheep Bay.....			1	1	1
Port Gravina.....	1	4			1
Knowles Head.....	3	3-6			3
Port Fidalgo.....			1	3	1
Bligh Island.....	1	10	2	3	3
Valdez Arm:					
Jack Bay.....			2	4	2
Sawmill Bay.....			1	4	1
Seven Sisters.....	2	17	1	9	26
Shelter Bay.....	2	2	2	1-4	4
Port Etches.....	11	1-7	6	1-3	17
Montague Island:					
No details.....			3	2-4	3
Zaikof Bay.....			1	1	1
Glacier Bay.....	1	10			1
Squire Island.....	1	1			1
Prince William Sound, east shore.....	4		11		15
Total.....	59		58		117
Per cent returned.....	48.8		26.2		34.2

CHUM SALMON

Seven Sisters.....	3	1-10			3
Port Etches.....	1	3			1
Anderson Bay.....	2	3-5			2
Hawkins Cutoff.....	1	3			1
Prince William Sound, east shore.....	1				1
Total.....	8		0		8
Per cent returned.....	34.8		0		18.6

¹ Three reported taken before date of tagging.
² One reported taken before date of tagging.

³ Date of capture not reported.

COOK INLET

RETURNS FROM EXPERIMENTS AT FLAT ISLAND

Three experiments were conducted at Flat Island, on June 14, June 27, and on July 23, in which 696 salmon were tagged. Of this number, 190 were reds; 313 were pinks; 173 were chums; 18 were cohos; and 2 were kings, neither of which was recaptured.

Red salmon.—The returns from the red salmon tagged at Flat Island are shown in Table 7 and indicate a northerly migration chiefly to the streams south of Anchor Point. The returns from the experiment of June 14 show a very definite migration into English Bay while in the later experiments fewer fish were taken in that vicinity.

This is in accord with the record of the counting weir in the river emptying into English Bay, which shows the run to be an early one and accounts for the number of fish taken there from the first experiment. Three fish tagged June 14 were taken in the waters of the Kodiak Island group 20 days after they were tagged, and 2 were taken in Prince William Sound after 12 and 21 days of freedom.

TABLE 7.—Returns from salmon tagged at Flat Island

RED SALMON

Locality of recapture	Date of tagging						Total number recaptured
	June 14		June 27		July 23		
	Number	Time in days	Number	Time in days	Number	Time in days	
Cook Inlet:							
No details	2	14-18					2
Flat Island	9	5-8	3	1	2	4-7	14
English Bay	9	2-16	2	3	1	1	12
Port Graham	1	5	2	24			3
Kachemak Bay—							
No details	1	18					1
Nubble Point	3	9-16	2	1-5			5
Mallard Bay					2	8	2
Bluff Point					1	4	1
Salamató Beach	1	6					1
Prince William Sound:							
McLeod Harbor					1	12	1
Port Etches			1	21			1
Kodiak Island:							
Cape Ugat	2	20					2
Between Malina Strait and Cape Ugat	1	20					1
Total	29		10		7		46
Per cent returned	22.8		22.2		38.9		24.2

PINK SALMON

Cook Inlet:							
No details	2	18-23	3	3-23	3	2-5	8
Windy Bay					1	3	1
Port Chatham			1	18			1
Flat Island			1	11	8	4-13	9
English Bay			1	28	23	1-28	24
Port Graham	2	17	4	4-11	3	2-30	41
Dangerous Cape					6	10	6
False Cape	1	21			4	1-2	5
Point Naskowhak	7	12-16	1	1			8
Kachemak Bay—							
No details	1	25	1	5	4	3-12	6
Seldovia Bay	7	18-46	7	6-28			14
Nubble Point	3	13-17	12	1-38	3	4	18
Tutka Bay					1	8	1
Mallard Bay					1		1
Sadie Cove			1	33			1
Bluff Point			2	9	10	1	12
Salamató Beach					1	2	1
Boulder Point					1	8	1
Kamishak Bay					1	5	1
Prince William Sound:							
Montague Island			1	35	1	8	1
Port Wells					1	11	1
Valdez Arm: Sawmill Bay							1
Total	23		35		104		162
Per cent returned	53.5		35.4		60.8		51.8

CHUM SALMON

Cook Inlet:							
No details			1	17			1
Windy Bay					1	3	1
Dogfish Bay (Koyuktolik Bay)					3	3	3
Flat Island			5	1-11	5	4-7	10
Port Graham	7	4-16	4	4-15	3	2-4	11
False Cape	2		2	1			3
Point Naskowhak		7-15					4
Kachemak Bay—							
No details	1	47	2	5-38			3
Seldovia Bay					1	1	1
Nubble Point			2	5-6	2	1-12	4
Tutka Bay					1	8	1
Sadie Cove					1	8	1
Total	10		16		17		43
Per cent returned	38.5		20.0		35.4		24.9

¹ One reported taken before date of tagging. ² Three reported taken before date of tagging. ³ Reported before date of tagging.

Pink salmon.—Of the 313 pink salmon tagged here, 162 (51.8 per cent) were recaptured. The data are presented in Table 7. There was a distinct northerly movement up Cook Inlet into Port Graham, and into the many bays in Kachemak Bay, where 32.7 per cent of the recaptures were made. Only 2 fish were reported taken north of Anchor Point and they were both tagged in the experiment of July 23. Two were taken south of Flat Island in Port Chatham and Windy Bay, 1 in Kamishak Bay on the west shore of Cook Inlet, and 3 were taken in different parts of Prince William Sound after periods of from 8 to 35 days.

Chum salmon.—As in the case of the pink salmon, the chums tagged at Flat Island were distributed to the bays and inlets along the east shore of Cook Inlet south of Anchor Point. Of the 173 chums tagged, 43 (24.9 per cent) were recaptured. The data are given in Table 7.

Coho salmon.—Eighteen cohos were tagged in the final experiment at Flat Island and 3 (16.7 per cent) were recaptured; 1 at Flat Island after 4 days, 1 in Port Graham after 2 days, and 1 in Mallard Bay after 8 days.

RETURNS FROM EXPERIMENTS AT NUBBLE POINT

Experiments were conducted here on June 26 and on July 18. Out of a total of 599 fish tagged, 151 were red salmon, 397 were pinks, and 51 were chums.

Red salmon.—The data relative to the capture of red salmon tagged at this locality are given in Table 8. From this table it may be seen that the fish were largely bound for spawning streams along the east shore of Cook Inlet. Of the recoveries, 21.6 per cent were made north of Anchor Point, indicating that a part of these fish were bound for the larger spawning streams of the upper inlet.

It is interesting to note that all fish other than those taken along the east shore of Cook Inlet were tagged early in the season. One was taken at Chisik Island on the west shore, 1 at Kalgin Island, 3 in the vicinity of Kodiak Island after from 4 to 8 days, and 2 in Prince William Sound after 13 and 17 days.

Pink salmon.—Of the 397 pink salmon tagged, 250 (63 per cent) were recaptured and the data are presented in Table 8. As in the case of the Flat Island experiments, the recoveries of tagged pink salmon were confined almost entirely to the bays indenting the east shore of Cook Inlet south of Anchor Point. One hundred and sixty-five (66 per cent) of the recaptures were made in Kachemak Bay, the streams of which provide the largest known pink salmon spawning grounds in Cook Inlet. One fish was taken at Anchor Point and one was taken north of Anchor Point at Deep Creek.

Chum salmon.—Fifty-one chum salmon were tagged in the experiment of June 26, and 26 (51 per cent) were recaptured. The data are presented in Table 13. The localities where recaptures were made are almost identical with the localities of recaptured chum salmon tagged at Flat Island.

TABLE 8.—Returns from salmon tagged at Nubble Point

RED SALMON

Locality of recapture	Date of tagging				Total number re-captured	Locality of recapture	Date of tagging				Total number re-captured
	June 26		July 18				June 26		July 18		
	Number	Time, in days	Number	Time, in days			Number	Time, in days	Number	Time, in days	
Cook Inlet:						Cook Inlet—Continued.					
No details.....	4	4-18			4	Salamato Beach.....	1	10			1
Flat Island.....	1	5			1	Moose Point.....	1	20			1
English Bay.....			1	21	2	Sunset Packing Co., trap No. 1.....	1	14			1
Port Graham.....	2	16-29			2	Kalgin Island.....	1	21			1
False Cape.....	1	9			1	Chisik Island.....	1	20			1
Point Naskowhak.....	3	2			3	Kodiak Island:					
Kachemak Bay—						Cape Ugat.....	2	8			2
No details.....	2	9-34	1	12	3	Malina Strait.....	1	4			1
Seldovia Bay.....	5	4-9	1	7	6	Prince William Sound:					
Nubble Point.....	8	1-7	1	2	9	Montague Island—					
Tutka Bay.....	2	9-19			2	Rocky Point.....	1	17			1
Bluff Point.....	2	11-12			2	Knowles Head.....	1	13			1
Cape Starichkof.....	1	10			1	Total.....	46		5		51
Cape Ninilchik.....	2	13			2	Per cent returned.....	33.3		38.5		33.8
Cape Ninilchik.....	1	29			1						
Ninilchik.....	1	7			1						
K. R. P. Co. trap No. 3.....	1				1						
Kenai.....			1	13	1						

PINK SALMON

Cook Inlet:						Cook Inlet—Continued.					
No details.....	20	4-29	30	1-9	50	Kachemak Bay—Con.					
Flat Island.....	1	6	1	13	2	Tutka Bay.....	7	9-35	4	2-13	11
English Bay.....			2	8-13	2	Sadie Cove.....	2	28-30	5	4-12	7
Port Graham.....	1	16	3	3-11	4	Mallard Bay.....	3	23-27	7	1-13	10
False Cape.....	1	27	5	1-7	6	Bluff Point.....	1	24	9	2	10
Point Naskowhak.....	5	2-4			5	Lila Bay.....			1	14	1
Kachemak Bay—						Anchor Point.....			5	1-6	5
No details.....	8	13-34	11	6-17	19	Deep Creek.....	1	8			1
Seldovia Bay.....	118	1-34	7	1-7	25	Total.....	115		135		250
Nubble Point.....	47	1-32	44	1-13	91	Per cent returned.....	54.8		72.2		63.0
McDonald Spit.....			1	6	1						

¹ Five reported taken before date of tagging.

TABLE 9.—Returns from chum salmon tagged at Nubble Point, June 26

Locality of recapture	Number	Time in days	Locality of recapture	Number	Time in days
Cook Inlet:			Cook Inlet—Continued.		
No details.....	2	2-4	Kachemak Bay—Continued.		
English Bay.....	1	29	Nubble Point.....	9	2-35
Port Graham.....	4	7-29	Tutka Bay.....	2	9-35
Point Naskowhak.....	1	2	Anchor Point.....	1	13
Kachemak Bay—			Total.....	26	
No details.....	1	32	Per cent returned.....	51.0	
Seldovia Bay.....	5	7-9			

RETURNS FROM EXPERIMENT AT CAPE STARICHKOF

Three hundred and fifty salmon were tagged at Cape Starichkof on July 22. Of this number 202 were red salmon, 121 were pinks, and 27 were cohos.

Red Salmon.—The returns from the red salmon tagged at Cape Starichkof, as given in Table 10, indicate that the principal migration is north along the east shore of Cook Inlet to the Kenai and Kasilof Rivers. A migration of lesser importance is southeast into Kachemak Bay. One tagged fish was captured on the west shore of Cook Inlet at Tyonek, and one was reported taken on August 29 at the mouth of the Ugashik River, Bristol Bay.

Pink Salmon.—The returns from pink salmon tagged at Cape Starichkof are shown in Table 11, and indicate the principal migration to be southeast into Kachemak Bay. Only 9 fish, or 11.3 per cent of the recaptures, were taken north of Anchor Point, while 73.8 per cent were made in Kachemak Bay.

Coho Salmon.—Only 4 (15.4 per cent) of the 27 cohos tagged at Cape Starichkof were recaptured; 1 was taken at False Cape, 1 in Seldovia Bay, 1 at Cape Starichkof, and 1 at Salamato Beach. The scattering returns of this species do not indicate any extensive or definite migration.

TABLE 10.—Returns from salmon tagged at Cape Starichkof, July 22

RED SALMON					
Locality of recapture	Number	Time in days	Locality of recapture	Number	Time in days
Cook Inlet:			Cook Inlet—Continued.		
No details.....	6	3- 8	Kalifonski.....	5	4- 7
False Cape.....	5	3- 5	The Sisters.....	4	2- 5
Kachemak Bay—			Waterfall.....	1	4- 9
No details.....	3	5-11	Kenai.....	5	3- 8
Seldovia Bay.....	1 ²		Salamato Beach.....	6	3- 4
Nubble Point.....	2	3- 9	East Foreland.....	1	4- 9
Sadie Cove.....	1	4	Nikishka Bay.....	5	8- 9
Mallard Bay.....	1	6	Boulder Point.....	2	2- 9
Bluff Point.....	11	2-10	Sunset Packing Co. trap No. 3.....	2	2
Anchor Point.....	3	2	North Foreland: Tyonek.....	2	36
Cape Starichkof.....	2	5	Bristol Bay: Ugashik River.....	1	
Ninilchik.....	2	5-10	Total.....	75	
Kalgin Island.....	2	7- 8	Per cent returned.....	37.1	
Humpy Point.....	1	3			
PINK SALMON					
Cook Inlet:			Cook Inlet—Continued.		
No details.....	4	2-9	Anchor Point.....	6	1-2
False Cape.....	1	3	Cape Starichkof.....	4	2-5
Kachemak Bay—			Ninilchik.....	1	5
No details.....	17	3-9	Kalifonski.....	1	5
Seldovia Bay.....	1 ²		Salamato Beach.....	3	6
Nubble Point.....	4	1-8	Kamishak Bay.....	1	
Tutka Bay.....	1 ²		Total.....	80	
Sadie Cove.....	5	2-9	Per cent return.....	66.1	
Mallard Bay.....	8	1-4			
Bluff Point.....	21	2			

¹ Reported taken before date of tagging.

² One reported taken before date of tagging.

RETURNS FROM EXPERIMENT AT NIKISHKA BAY

One experiment was conducted here on July 21, at the height of the red salmon run and during the weekly 48-hour closed season, so that the fish had an opportunity to escape recapture for considerable time. Of the 248 fish tagged, 245 were red salmon and 3 were cohos. For some time there has been a question among cannerymen as well as Bureau of Fisheries officials, as to whether the red salmon caught on the east shore of Cook Inlet north of East Foreland are bound for spawning grounds in the Susitna River or other rivers in the upper inlet, or whether they first strike the east shore north of East Foreland and follow it south to the Kenai and Kasilof Rivers south of East Foreland. The data are presented in Table 11. From this table it is quite apparent that most of these fish were bound for the spawning grounds south of East Foreland, and 46.5 per cent of the recoveries were made in the immediate vicinity of the Kenai and Kasilof Rivers. Five tagged fish were recaptured on the west shore of Cook Inlet at Point Harriet, West Foreland, and North Foreland. The northerly and westerly migration appears to be of slight importance as com-

pared with the migration to the Kenai and Kasilof Rivers where important spawning grounds are located.

None of the cohos were recaptured.

TABLE 11.—Returns from red salmon tagged at Nikishka Bay, July 21

Locality of recapture	Number	Time in days	Locality of recapture	Number	Time in days
East shore of Cook Inlet:			East shore of Cook Inlet—Continued.		
Windv Bay.....	12		Moose Point.....	2	3-4
Port Graham.....	1	1	Point McManus.....	1	3
Kachemak Bay—			West shore Cook Inlet:		
Nubble Point.....	1	1	Point Harriet.....	2	2-3
Bluff Point.....	1	3	North Foreland—		
Kalifornski.....	1	5	Tyonck.....	1	2
Kenai.....	6	6-9	Cottonwood Point.....	1	6
Salamat Beach.....	11	1-4	Three Mile Creek.....	1	4
East Foreland.....	2	3	Total.....	37	
Nikishka Bay.....	1	6	Per cent returned.....	15.1	
Sunset Packing Co. No. 3.....	1				
Sunset Packing Co. No. 1.....	12				

¹ Reported taken before date of tagging.

² Two reported taken before date of tagging.

CONCLUSIONS

The percentages of recaptured tagged fish vary greatly with the species and to some extent with the locality and date of tagging. The data are presented in Table 12.

The percentages of tagged pink salmon recaptured are more uniform and are consistently higher, both in Prince William Sound and Cook Inlet, than those obtained for other species. The extremely high returns of pink salmon from the Cook Inlet experiments are most striking, because they are so much greater than any obtained in experiments conducted in other parts of Alaska. In an earlier report³ it was pointed out that the percentage returns indicate, at best, a minimum percentage of the fish population captured in the commercial fishery because various factors are at work that keep the percentage returns of tagged fish below the percentage of untagged fish that are captured and with which the tagged fish were associated at the time of their liberation. The retention of tags as souvenirs by fishermen, and the failure of the cannery men to report tags received by them because the information required was wanting or for other reasons, are important factors in keeping down the known percentage of recaptures. In Cook Inlet, where 50 to 66 per cent of the released pink salmon were again taken, there can be no doubt that the actual drain on the resource is very much greater than those proportions; indeed it seems possible that the drain is so great as to menace the perpetuation of the supply.

TABLE 12.—Percentage of tagged fish recaptured, 1929^a

Locality of tagging	Red	Pink	Chum	Coho	Locality of tagging	Red	Pink	Chum	Coho
Prince William Sound:					Cook Inlet:				
Montague Strait.....	11.1	35.6			Flat Island.....	24.2	51.8	24.9	16.7
Montague Point.....		36.1			Nubble Point.....	33.8	63.0	51.0	
Hinchinbrook Entrance.....		48.5			Nikishka Bay.....	15.1			
Knight Island Passage.....		35.5			Cape Starichkof.....	37.1	66.1		15.4
Johnstone Point.....	16.7	34.2	18.6	33.3					

^a Total number tagged, 4,143 total number recaptured, 1,613; percentage recaptured, 38.9 per cent.

³ Second experiment in tagging salmon in the Alaska Peninsula Fisheries Reservation, summer of 1923, by Charles H. Gilbert and Willis H. Rich. Bulletin, U. S. Bureau of Fisheries, Vol. XLII, 1926 (1927).

The returns obtained in Prince William Sound correspond very closely to those obtained from experiments in Southeastern Alaska.

Because the salmon runs in Cook Inlet and Prince William Sound are quite distinct, the experiments in those districts have been considered separately. In Prince William Sound 2,172 of the 2,250 fish tagged were pink salmon, the most important species in that district. The results may be summarized briefly as follows:

1. The pink salmon entering Prince William Sound through Montague Strait are distributed to virtually all parts of the sound. Two routes of migration are indicated; one is northeast along Montague Island to Hinchinbrook Entrance and from there to the bays and inlets along the east shore; and the other is northwest through Knight Island Passage to the streams on the west shore.

2. The pink salmon taken at Montague Point, like those in Montague Strait, are widely scattered to all parts of Prince William Sound. These fish may have entered the sound through Montague Strait, in which case some of the fish complete their migration to the spawning grounds on the east shore while others turn back over the route already covered along Montague Island and some continue to the spawning grounds on the west shore. Some of the fish taken here may also have entered Prince William Sound through Hinchinbrook Entrance in which case the liberated fish were a mixed lot. This seems more probable and would account for the scattering of the fish from Montague Point, whereas if only fish entering through Montague Strait had been liberated at Montague Point, the northeasterly migration alone would have been expected.

3. The distribution of fish tagged at Port Etches in Hinchinbrook Entrance was almost exclusively to the bays along the east shore of Prince William Sound.

4. Fish caught at Squire Island in Knight Island Passage are derived in large part from those entering Prince William Sound through Montague Strait and are bound mainly for the streams along the western and northern shores of those waters.

5. The fish passing Johnstone Point are bound chiefly for the streams on the east shore of Prince William Sound.

6. In most of the experiments there were no differences in the distribution of pink salmon tagged early in the season as compared with those tagged later in the season at the same place. Usually the fish tagged in the earlier experiments were recaptured after a longer period of freedom than those tagged later in the season—indicating a slower rate of travel.

In Cook Inlet, 1,893 salmon of all species were released during the 1929 tagging operations. Of this number 2 were kings, neither of which were recaptured; 788 were reds; 831 were pinks; 224 were chums; and 48 were cohos. The conclusions, based on data obtained from the four experiments conducted there, are as follows:

1. The distribution of the fish tagged at Flat Island varied with the species but was principally north in Cook Inlet. The red salmon tagged here on June 14 were taken in considerable numbers in the vicinity of English Bay, and a large percentage of all recaptures was made along the east shore of Cook Inlet south of Anchor Point, indicating that the red salmon passing Flat Island are largely bound for the smaller spawning streams in the lower inlet. Three reds were taken near Kodiak Island, and two were taken in Prince William Sound. The pinks, chums, and cohos were distributed along the east shore of Cook Inlet south of Anchor Point. Three pinks were taken in Prince William Sound.

2. The salmon taken at Nubble Point were distributed over much the same region as those tagged at Flat Island. A greater number of the red salmon, however, were taken north of Anchor Point. Three reds were taken near Kodiak Island and two were taken in Prince William Sound. As before, the pinks and chums were recaptured in greatest numbers in the bays of Kachemak Bay. It is interesting to note that most of the tagged salmon captured in localities other than Cook Inlet were tagged in the early part of the season.

3. The red salmon tagged at Cape Starichkof were chiefly distributed along the east shore of Cook Inlet, north to the Kenai and Kasilof Rivers. A few were taken in Kachemak Bay. The migration of the pink salmon was almost exclusively to Kachemak Bay. If any pink salmon do spawn in the streams north of Anchor Point, it is probable that the run is quite late, since only in the later experiments were recaptures of tagged pink salmon reported in the upper reaches of Cook Inlet, and then in numbers too few to indicate a definite migration.

4. The main route of migration of the salmon caught at Nikishka Bay is south along the east shore of Cook Inlet to the Kenai and Kasilof Rivers, where important spawning areas are located. Fish were also distributed along the east shore north of Nikishka Bay and along the west shore. The northerly migration seems to be of slight importance.

